BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA

DOCKET NO. 2018-1-E

In the Matter of Annual Review of Base Rates for Fuel Costs for Duke Energy Progress, LLC	))))	**DIRECT TESTIMONY** **OF JOSEPH A. MILLER, JR. FOR** **DUKE ENERGY PROGRESS, INC.**

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Joseph A. Miller, Jr. and my business address is 526 South Church Street, Charlotte, North Carolina 28202.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am Vice President of Central Engineering and Services for Duke Energy Business Services, LLC ("DEBS"). DEBS is a service company subsidiary of Duke Energy Corporation ("Duke Energy") that provides services to Duke Energy and its subsidiaries, including Duke Energy Progress, LLC ("DEP" or the "Company") and Duke Energy Carolinas, LLC ("DEC").

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND.

A. I graduated from Purdue University with a Bachelor of Science degree in mechanical engineering. I also completed twelve post graduate level courses in Business Administration at Indiana State University. My career began with Duke Energy (d/b/a Public Service of Indiana) in 1991 as a staff engineer at Duke Energy Indiana's Cayuga Steam Station. Since that time, I have held various roles of increasing responsibility in the generation engineering, maintenance, and operations areas, including the role of station manager, first at Duke Energy Kentucky's East Bend Steam Station, followed by Duke Energy Ohio's Zimmer Steam Station. I was named General Manager of Analytical and Investments Engineering in 2010, and became General Manager of Strategic Engineering in 2012 following the merger between Duke Energy and Progress Energy, Inc. I became the Vice President of Central Engineering and Services in 2014.

Q. WHAT ARE YOUR DUTIES AS VICE PRESIDENT OF CENTRAL ENGINEERING AND SERVICES?

A. In this role, I am responsible for providing engineering, environmental compliance planning, generation and regulatory strategy, technical services, and maintenance services, for Duke Energy's fleet of fossil, hydroelectric, and solar (collectively, "Fossil/Hydro/Solar") facilities.

Q. HAVE YOU TESTIFIED BEFORE THIS COMMISSION IN ANY PRIOR PROCEEDINGS?

A. Yes. I testified before the Public Service Commission of South Carolina in DEP's 2016 and 2017 annual fuel proceedings in Docket Nos. 2016-1-E and 2017-1-E, as well as in DEC's 2016 and 2017 annual fuel proceedings in Docket Nos. 2016-3-E and 2017-3-E, respectively. I have also testified on multiple occasions on behalf of Duke Energy in proceedings before this and other state commissions.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to (1) describe DEP's Fossil/Hydro/Solar generation portfolio and changes made since the 2017 fuel cost recovery proceeding, as well as those expected in the near term, (2) discuss the performance of DEP's Fossil/Hydro/Solar facilities during the period of March 1, 2017 through February 28, 2018 (the "review period"), (3) provide information on significant fossil/hydro outages that occurred during the review period, and (4) provide information concerning environmental compliance efforts.

Q. PLEASE DESCRIBE DEP'S FOSSIL/HYDRO/SOLAR GENERATION PORTFOLIO.

A. The Company's Fossil/Hydro/Solar generation portfolio consists of 9,268 megawatts ("MWs") of generating capacity, made up as follows:

Coal-fired -	3,544 MWs
Combustion Turbines -	2,867 MWs
Combined Cycle Turbines -	2,568 MWs
Hydro -	227 MWs
Solar -	62 MWs[1]

The 3,544 MWs of coal-fired generation represent three generating stations and a total of seven units. These units are equipped with emission control equipment, including selective catalytic reduction ("SCR") equipment for removing nitrogen oxides ("NO_x"), flue gas desulfurization ("FGD" or "scrubber") equipment for removing sulfur dioxide ("SO_2"), and low NO_x burners. This inventory of coal-fired assets with emission control equipment enhances DEP's ability to maintain current environmental compliance and concurrently utilize coal with increased sulfur content – providing flexibility for DEP to procure the most cost-effective options for fuel supply.

The Company has a total of 33 simple cycle combustion turbine ("CT") units, the larger 14 of which provide 2,183 MWs, or 76% of CT capacity. These 14 units are located at the Asheville, Darlington, Richmond County, and Wayne County facilities, and are equipped with water injection and/or low NO_x burners for NO_x

[1] This value represents the relative dependable capacity contribution to meeting summer peak demand, based on the Company's integrated resource planning metrics. The nameplate capacity of the Company's solar facilities is 141 MWs.

control. The 2,568 MWs shown as "Combined Cycle Turbines" ("CC") represent four power blocks. The H.F. Lee Energy Complex CC power block ("Lee CC") has a configuration of three CTs and one steam turbine. The two Richmond County power blocks located at the Smith Energy Complex consist of two CTs and one steam turbine each. The Sutton Combined Cycle at Sutton Energy Complex ("Sutton CC") consists of two CTs and one steam turbine. The four CC power blocks are equipped with SCR equipment, and all nine CTs have low NOx burners. The steam turbines do not combust fuel and, therefore, do not require NO_x controls. The Company's hydro fleet consists of 15 units providing 227 MWs of capacity. The Company's solar fleet consists of four sites providing 62 MWs of dependable capacity.

Q. WHAT CHANGES HAVE OCCURRED WITHIN THE FOSSIL/HYDRO/SOLAR PORTFOLIO SINCE DEP'S 2017 ANNUAL FUEL PROCEEDING?

A. Sutton CT Unit 1 retired in March 2017, which reduced capacity by 11 MWs. Sutton CT 2A and 2B were retired in July 2017, which reduced capacity by 48 MWs. Corresponding with the retirements, the company brought online two new fast start CTs at Sutton in July 2017, adding 39 MWs of capacity for each CT for a total of 78 MWs of capacity. Darlington CT Unit 9 retired in June 2017, which reduced capacity by 50 MWs.

Q. WHAT ARE DEP'S OBJECTIVES IN THE OPERATION OF ITS FOSSIL/HYDRO/SOLAR FACILITIES?

A. The primary objective of DEP's Fossil/Hydro/Solar generation department is to

provide safe, reliable and cost-effective electricity to DEP's customers. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with procedures, guidelines, and a standard operating model. Like safety, environmental compliance is a "first principle," and DEP works very hard to achieve high level results.

The Company achieves compliance with all applicable environmental regulations and maintains station equipment and systems in a cost-effective manner to ensure reliability. The Company also takes action in a timely manner to implement work plans and projects that enhance the safety and performance of systems, equipment, and personnel, consistent with providing low-cost power options for DEP's customers. Equipment inspection and maintenance outages are generally scheduled during the spring and fall months when customer demand is reduced due to milder temperatures. These outages are well-planned and executed with the primary purpose of preparing the unit for reliable operation until the next planned outage.

Q. HOW MUCH GENERATION DID EACH TYPE OF GENERATING FACILITY PROVIDE FOR THE REVIEW PERIOD?

A. For the review period, DEP's total system generation was 62,461,644 megawatt-hours ("MWHs"), of which 33,128,805 MWHs, or approximately 53%, was provided by the Fossil/Hydro/Solar fleet. The breakdown includes a 37% contribution from gas facilities, 15% contribution from coal-fired stations, 0.9% contribution from hydro facilities, and 0.4% from solar facilities.

The Company's portfolio includes a diverse mix of units that, along with its nuclear capacity, allow DEP to meet the dynamics of customer load requirements in a logical and cost-effective manner. Additionally, DEP has utilized the Joint Dispatch Agreement, which allows generating resources for DEP and DEC to be dispatched as a single system to enhance dispatching at the lowest possible cost. The cost and operational characteristics of each unit generally determine the type of customer load situation (e.g., base and peak load requirements) that a unit would be called upon or dispatched to support.

Q. HOW DID DEP COST EFFECTIVELY DISPATCH THE DIVERSE MIX OF GENERATING UNITS DURING THE REVIEW PERIOD?

A. The Company, like other utilities across the U.S., has experienced a change in the dispatch order for each type of generating facility due to continued favorable economics resulting from the low pricing of natural gas. Further, the addition of new CC units within DEP's portfolio in recent years has provided DEP with additional natural gas resources that feature state-of-the-art technology for increased efficiency and significantly reduced emissions. These factors promote the use of natural gas and provide real benefits in cost of fuel and reduced emissions for customers. Gas fired facilities provided 69% of the DEP Fossil/Hydro/Solar generation during the review period.

Q. WHAT WAS THE HEAT RATE FOR DEP'S COAL-FIRED AND COMBINED CYCLE UNITS DURING THE REVIEW PERIOD?

A. Heat rate is a measure of the amount of thermal energy needed to generate a given amount of electric energy and is expressed as British thermal units ("Btu") per

kilowatt-hour ("kWh"). A low heat rate indicates an efficient fleet that uses less heat energy from fuel to generate electrical energy. Over the review period, the Company's seven coal units produced 29% of the Fossil/Hydro/Solar generation, with the average heat rate for the coal-fired units being 10,739 Btu/kWh. The most active station during this period was Roxboro, providing 70% of the coal production for the fleet with a heat rate of 10,364 Btu/kWh. During the review period, the Company's four combined cycle power blocks produced 62% of the Fossil/Hydro/Solar generation, with an average heat rate of 7,103 Btu/kWh.

Q. PLEASE DISCUSS THE OPERATIONAL RESULTS FOR DEP'S FOSSIL/HYDRO/SOLAR FLEET DURING THE REVIEW PERIOD.

A. The Company's generating units operated efficiently and reliably during the review period. Several key measures are used to evaluate the operational performance depending on the generator type: (1) equivalent availability factor ("EAF"), which refers to the percent of a given time period a facility was available to operate at full power, if needed (EAF is not affected by the manner in which the unit is dispatched or by the system demands; it is impacted, however, by planned and unplanned maintenance (*i.e.*, forced) outage time); (2) net capacity factor ("NCF"), which measures the generation that a facility actually produces against the amount of generation that theoretically could be produced in a given time period, based upon its maximum dependable capacity (NCF *is* affected by the dispatch of the unit to serve customer needs); (3) equivalent forced outage rate ("EFOR"), which represents the percentage of unit failure (unplanned outage hours and equivalent unplanned derated hours); a low EFOR represents fewer unplanned outage and

derated hours, which equates to a higher reliability measure; and, (4) starting reliability ("SR"), which represents the percentage of successful starts.

The following chart provides operational results categorized by generator type, as well as results from the most recently published North American Electric Reliability Council ("NERC") Generating Unit Statistical Brochure ("NERC Brochure") representing the period 2012 through 2016. The NERC data reported for the coal-fired units represents an average of comparable units based on capacity rating.

Generator Type	Measure	Review Period	2012-2016	Nbr of Units
		DEP Operational Results	NERC Average	
Coal-Fired Test Period	EAF	80.1%	82.0%	446
	NCF	30.2%	58.3%	
	EFOR	8.0%	7.6%	
Coal-Fired Summer Peak	EAF	90.5%	n/a	n/a
Total CC Average	EAF	85.6%	84.8%	301
	NCF	78.5%	53.0%	
	EFOR	0.73%	5.5%	
Total CT Average	EAF	80.0%	87.6%	826
	SR	98.1%	98.1%	
Hydro	EAF	96.1%	81.1%	1,120

Q. PLEASE DISCUSS SIGNIFICANT OUTAGES OCCURRING AT DEP'S FOSSIL/HYDRO/SOLAR FACILITIES DURING THE REVIEW PERIOD.

A. In general, planned maintenance outages for all fossil and hydro units are scheduled for the spring and fall to maximize unit availability during periods of peak demand.

Most units had at least one short planned outage during this review period to inspect and maintain plant equipment.

Roxboro Unit 4 had a planned outage in Spring 2017. The primary purpose of the outage was to tie-in the new dry bottom ash system. Asheville Unit 1 had a planned outage in Spring 2017 to perform inspections and maintenance on the boiler, SCR, FGD, and air preheaters. Roxboro Units 1-4 had a planned outage in Fall 2017. The primary purpose of the outage was to upgrade the FGD control systems and to perform boiler maintenance.

The CC fleet performed planned outages at Richmond County CC PB4 and PB5 in Spring 2017. The primary purpose of the PB4 and PB5 outages was to perform borescope inspections on the combustion turbines and perform balance of plant equipment maintenance.

The CT fleet performed planned outages in Spring and Fall 2017. In Spring 2017 Asheville CT Unit 4 had a planned outage to perform a combustion inspection and to upgrade the controls system. In Fall 2017 Richmond County CT Unit 1 and Darlington Unit 12 and Unit 13 had planned outages. The primary purpose of the Richmond County CT outage was to perform a generator rotor rewind and re-wedge the stator. The outage on Darlington Unit 12 and Unit 13 was to upgrade the protection relay system.

Q. HOW DOES DEP ENSURE EMISSIONS REDUCTIONS FOR ENVIRONMENTAL COMPLIANCE?

A. The Company has installed pollution control equipment on coal-fired units, as well as new generation resources, in order to meet various current federal, state, and local

reduction requirements for NO_x and SO_2 emissions. The SCR technology that DEP currently operates on the coal-fired units uses ammonia or urea for NO_x removal and the scrubber technology employed uses crushed limestone or lime for SO_2 removal. SCR equipment is also an integral part of the design of the newer CC facilities in which aqueous ammonia (19% solution of NH_3) is introduced for NO_x removal.

Overall, the type and quantity of chemicals used to reduce emissions at the plants varies depending on the generation output of the unit, the chemical constituents in the fuel burned, and/or the level of emissions reduction required. The Company is managing the impacts, favorable or unfavorable, as a result of changes to the fuel mix and/or changes in coal burn and utilization of non-traditional coals. Overall, the goal is to effectively comply with emissions regulations and provide the optimal total-cost solution for operation of the unit. The Company will continue to leverage new technologies and chemicals to meet both present and future state and federal emissions requirements including the Mercury and Air Toxics Standards ("MATS") rule. MATS chemicals that DEP may use in the future to reduce emissions include, but may not be limited to, activated carbon, mercury oxidation chemicals, and mercury re-emission prevention chemicals. Company witness Ward provides the cost information for DEP's chemical use and forecast.

Q. DOES THAT CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.